

Evaluation of Potential Future Costs at Arizona Superfund Sites

Arizona Department of Environmental Quality

January 2014

INTRODUCTION

The objective of this study was to estimate the potential future costs that may be incurred by the state of Arizona's Water Quality Assurance Revolving Fund (WQARF). WQARF funds are used, in part, to conduct investigations to determine if a release or threatened release of a hazardous substance exists; conduct remedial investigations, feasibility studies, health effect studies, and risk assessments; take remedial actions; and fund orphan shares (Arizona Revised Statutes § 49-282(E)(2)). The estimation of potential future costs to the program required the analysis of three types of sites:

- 1) Sites currently listed on the WQARF Registry that are in some stage of remedial investigation and for which a remedial action has and/or will take place in the future.
- 2) Sites in some stage of a preliminary investigation (PI) that may or may not be listed on the WQARF Registry in the future.
- 3) Sites that are being investigated or remediated under federal supervision for which the WQARF program is currently or may become responsible for all or at least some of the associated costs in the future.

The primary tasks to be accomplished as part of this project were as follows:

- Determine the probable course of action at each site, based on currently available information; and
- Estimate the potential cost over the lifetime of each site.

The parametric cost modeling software program Remedial Action Cost Engineering and Requirements (RACER) was used to estimate the potential cost at each site. The program uses a combination of user-defined, site-specific information and generic engineering solutions to estimate remediation costs from an extensive cost database. Site-specific information was gathered directly from Arizona Department of Environmental Quality (ADEQ) project managers and the WQARF program's independent consultants, as well as ADEQ Legal Support Unit Staff with knowledge of the status of PI sites. Site cost estimates for this study were initiated in October 2013 and completed over the course of approximately eight weeks.

Estimating the total cost to the WQARF program for the investigation and remediation of sites requires making certain assumptions about future activities. The primary assumptions were:

- Unless otherwise specified, the primary remedial objective considered for each site was to allow for the present and reasonably foreseeable use of all contaminated media.
- Any remedial action will take no longer than 30 years to meet all site-specific remedial objectives. Thus, all monitoring and remedial operations were limited to 30 years beyond the implementation of a given remedial action.
- For each site analyzed herein, the WQARF program may become financially responsible for the site at any time, regardless of previous actions taken by responsible parties.
- Standard remedial technologies, such as pump and treat for groundwater plume containment, were chosen (in cases where a remedial technology was not yet selected or in place) over more innovative approaches that would require more extensive investigation and field testing.

While calibrating RACER program estimates to contractor-provided project costs (discussed in further detail below), it was determined that RACER default labor rates were much higher than Arizona contractor estimates. In this case, average labor rates from actual Arizona contractors were chosen in place of the RACER defaults. Additionally, the default RACER mark-up percentages include an 11% “owner cost” which would represent an approximate cost to ADEQ for project oversight. Costs incurred by WQARF for salaries and other general and administrative expenses are not directly related to the remediation costs at a particular site. Therefore, these costs were estimated separately by multiplying the current WQARF-funded costs for salaries/G&A by the inflation rate over 30 years (Table 1).

Project Data Collection

For each of the WQARF and Federal sites, all site-related information was obtained directly from the individual ADEQ project managers and, when necessary, the WQARF program’s independent consultants. Project managers were asked to use their detailed knowledge and experience with each site to determine the most appropriate actions to be taken. They provided specific information about activities such as well installation, monitoring events, and remedial actions. For many of these sites there remains considerable uncertainty with regard to future actions, often because the site has not yet been fully characterized. In such cases project manager and other ADEQ staff experience, along with examples from similar sites, were used to determine the probable course of action. All inputs were chosen based on their ability to meet the site’s remedial objectives and to utilize the most cost-effective methods wherever possible. In most cases less traditional technologies (e.g. in-situ chemical oxidation) that would require extensive study and field testing were not chosen as the predicted final remedy unless specific information existed regarding their potential effectiveness.

Information for sites that are currently in the preliminary investigation stage was obtained after an extensive internal records search. Information from ADEQ memoranda compiled by Legal Support Unit staff was used to determine which actions may be necessary at each site. However, due to the limited available information, significant assumptions had to be made. To ensure consistency, a decision process was used to determine what actions might be required for a given site based on select criteria such as contaminant type, affected media, and estimations of overall site size and complexity (Figures 1-3). As with the sites on the WQARF Registry, less traditional technologies that would require extensive study and field testing were not chosen as the final remedy at this time, though they may be considered in the future when more information is available. Remedial actions were implemented for no more than 30 years, consistent with the projections made for current WQARF sites.

Estimate Calibration

Because user inputs are necessary to tailor cost estimates to specific sites and circumstances, the choice of such inputs is important to obtaining a reasonable cost estimate. Therefore, every effort was made to enter the most accurate information possible. These efforts included extensive communication with each project manager, discussions with RACER associates, and comparisons to contractor-provided information when available.

document reported an uncertainty of +/-50% for WQARF-site cost estimates¹ while the U.S. Environmental Protection Agency estimates an uncertainty of -35/+50% for cost estimates included in feasibility studies⁴. Although no attempt was made to quantify uncertainty for this current study, its uncertainty is likely to also be within these ranges and the cost estimates are thought to be conservatively low for several reasons:

- It is not possible to account for every eventual detail of remedial activities over the lifetime of a site, especially for preliminary investigation sites for which little information is known.
- When selecting future remediation strategies, standard technologies were chosen that do not require extensive bench and pilot-scale testing to determine feasibility.
- The inflation rate of 1.8% is relatively low when compared to historical inflation rates.

RESULTS

Table 4 presents a cost breakdown of estimated total cost by site, with escalation. Potential site costs are displayed in Figure 4 as a function of the type of site (WQARF, Federal or PI). Appendix B provides a more complete cost breakdown by site, site type, and phase of activity and includes an estimation of net present value.

A total of 33 sites that are currently being remediated under WQARF-program supervision were evaluated to determine future costs. The estimated median cost for site-remediation is approximately \$7.2 million. A number of factors influenced the estimation of costs including site size, contamination type, current phase of the WQARF process, and projected remedial action. As presented in Table 4, costs ranged from \$15,144 to \$139,527,680. The RACER-generated total potential cost for all WQARF sites currently listed in the Registry with escalation is \$429 million. The total estimated net present value for the WQARF sites is \$211 million.

Twelve sites were evaluated for which there is currently some federal involvement. These sites may have state lead authority or oversight, some state financial participation, and/or the potential to become a state-lead site in the future. For these “federal” sites, the only remedial actions that were included were those that may possibly be paid for by the state. Therefore, RACER cost estimates for these sites may not represent the total lifetime cost for remediation. The median potential cost to the WQARF program for these sites is approximately \$3.4 million. As presented in Table 4, costs ranged from \$60,000 to \$37,761,415. Individual site costs were dependent on many of the same factors as WQARF sites. The RACER-generated total potential cost for the “federal” sites with escalation is \$95 million. The total estimated net present value for the federal sites is \$73 million.

After careful consideration of available information, 39 sites currently in the PI stage were determined to have the potential to become WQARF sites in the future. For each of these sites, the decision process presented in Figure 1 was used to determine what PI work remains to be completed at a given site and how cost estimates for the Remedial Investigation/Feasibility Study (RI/FS) work would be made. The specific remedial actions to be modeled with RACER were chosen based on a determination of how much work has been completed to date and the type of contamination present. Information regarding

Table 4. Estimated future costs (with escalation) incurred by WQARF for each site.

Site Name	Site Category	Location	Total (w/escalation)
7th Street and Arizona Avenue	WQARF	Tucson	\$5,548,352
7th Avenue and Bethany Home Road	WQARF	Phoenix	\$4,685,581
16th Street and Camelback Road	WQARF	Phoenix	\$686,304
20th Street and Factor Avenue	WQARF	Yuma	\$12,255,175
56th Street and Earll	WQARF	Phoenix	\$8,041,101
Broadway-Pantano	WQARF	Tucson	\$60,509,751*
Central and Camelback	WQARF	Phoenix	\$2,573,483
Cooper & Commerce	WQARF	Gilbert	\$10,375,882
East Central Phoenix - 24th Street and Grand Canal	WQARF	Phoenix	\$13,982,422
East Central Phoenix - 32nd Street and Indian School	WQARF	Phoenix	\$16,227,148
East Central Phoenix - 38th Street and Indian School Road	WQARF	Phoenix	\$14,207,755
East Central Phoenix - 40th Street and Indian School Road	WQARF	Phoenix	\$14,486,490
East Central Phoenix - 40th Street and Osborn Road	WQARF	Phoenix	\$14,107,489
East Central Phoenix - 48th Street and Indian School Road	WQARF	Phoenix	\$15,375,472
Shannon Road/El Camino del Cerro	WQARF	Tucson	\$14,227,819
Estes Landfill	WQARF	Phoenix	\$590,616
Klondyke Tailings	WQARF	Klondyke	\$7,189,591
Los Reales Landfill	WQARF	Tucson	\$4,531,694
Miracle Mile	WQARF	Tucson	\$9,342,941
Park-Euclid	WQARF	Tucson	\$5,801,338
Payson PCE	WQARF	Payson	\$4,915,746
Silverbell Landfill	WQARF	Tucson	\$19,650,220
South Mesa	WQARF	Gilbert/Mesa	\$2,438,218
Tonto Drive and Cherry Street	WQARF	Payson	\$15,144
Tyson Wash	WQARF	Quartzsite	\$4,070,703
Vulture Mill	WQARF	Wickenburg	\$198,081
West Central Phoenix - East Grand Avenue	WQARF	Phoenix	\$1,551,612
West Central Phoenix - North Canal Plume	WQARF	Phoenix	\$2,194,356
West Central Phoenix - North Plume	WQARF	Phoenix	\$11,691,428
West Central Phoenix - West Grand Avenue	WQARF	Phoenix	\$36,873
West Central Phoenix - West Osborn Complex	WQARF	Phoenix	\$8,026,975
West Van Buren	WQARF	Phoenix	\$139,527,680
Western Ave Plume	WQARF	Goodyear/Avondale	\$285,979
Kachina Joray	Federal	Phoenix	\$1,504,168
Nelson Engineering	Federal	Phoenix	\$261,088
Motorola 52nd Street OU2 RI/FS	Federal	Phoenix	\$711,831
Section 9 Lease	Federal	Cameron	\$10,198,069
Tucson Rifle Club	Federal	Three Points	\$987,630

**Appendix B - DRAFT
RACER Cost Estimates
Individual Cost Breakdown by Phase**

Feasibility Study - Report Completion	\$60,952
Feasibility Study - PRAP & ROD	\$32,099
Design	\$88,498
Remedial Action - Pump & Treat	\$1,156,976
Feasibility Study - Vertical Aquifer Profiling	\$516,744
Long Term O&M - P&T	\$5,612,814
Long Term O&M - GW monitoring - 40 wells	\$1,063,582
Present Cost	\$9,010,842
Net Present Value	\$6,859,001
Total Cost (with escalation)	\$11,691,428

Project Name: West Central Phoenix-North Plume

Project Name: West Central Phoenix - West Grand Avenue

Location Modifier: PHOENIX, AZ

PRAP and ROD	\$23,146
Site Closeout	\$12,914
Present Cost	\$36,060
Net Present Value	\$34,961
Total Cost (with escalation)	\$36,873

Project Name: West Central Phoenix - West Grand Avenue

Project Name: West Central Phoenix - West Osborn Complex

Location Modifier: PHOENIX, AZ

Feasibility Study - PRAP and ROD	\$32,099
Design	\$60,355
Remedial Action - GW P&T	\$664,425
Operations and Maintenance - GW P&T	\$2,787,003
Long Term Monitoring	\$2,282,507
Site closeout	\$72,794
Remedial Action - Deep Monitoring Well	\$51,237
Present Cost	\$5,950,419
Net Present Value	\$4,148,729
Total Cost (with escalation)	\$8,026,975

Project Name: West Central Phoenix - West Osborn Complex

Project Name: West Van Buren

Location Modifier: PHOENIX, AZ

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RACER Cost Estimates
Individual Cost Breakdown by Phase**

Feasibility Study - Initial Report Work	\$76,200
Feasibility Study - Report Completion	\$71,195
PRAP and ROD	\$32,099
Design - Three Soil Vapor Extraction Systems	\$58,552
Remedial Action - Three Soil Vapor Extraction Systems	\$622,099
Operations and Maintenance - Three Soil Vapor Extraction Systems	\$988,388
Remedial Action - Groundwater Pump and Treat, VOC/Chrome	\$1,145,270
Remedial Action - Groundwater Pump and Treat, VOC	\$452,835
Operations and Maintenance - SVE system at Prudential (4 years)	\$286,267
Remedial Action - Roosevelt Irrigation District Wellhead Treatment - 4 systems	\$10,467,657
Design - Roosevelt Irrigation District Wellhead Treatment - 4 systems	\$271,066
Operations and Maintenance RID Wellhead Treatment - 8 systems (30 years)	\$54,299,146
Long-Term Monitoring (30 years)	\$5,111,048
Operations and Maintenance - Groundwater Pump and Treat, VOC (30 years)	\$7,836,534
Operations and Maintenance - Groundwater Pump and Treat, VOC/Chrome (30 years)	\$9,602,983
Operations and Maintenance - Groundwater Pump and Treat, VOC/Chrome (30 years)	\$9,602,983
Remedial Action - Groundwater Pump and Treat, VOC/Chrome	\$1,145,270
Remedial Action - Excavation of chrome VI-contaminated soil	\$620,782
Design - Pump and Treat Systems	\$211,406
Site Closeout	\$303,903
Present Cost	\$103,205,682
Net Present Value	\$74,565,772
Total Cost (with escalation)	\$139,527,680

Project Name: West Van Buren

Project Name: Western Avenue Plume

Feasibility Study - PRAP, ROD and Community Involvement	\$50,726
Remedial Action - MNA	\$169,725
Site Closeout	\$23,013
Present Cost	\$243,464
Net Present Value	\$204,842
Total Cost (with escalation)	\$285,979

Project Name: Western Avenue Plume

Federal Sites

Project Name: Kachina Joray

Location Modifier: PHOENIX, AZ